FUEL-BURNING EQUIPMENT DIMENSIONS REQUIRED BY SMOKE-ABATEMENT ORDINANCES

BY J. F. BARKLEY AND R. E. MORGAN

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INTRODUCTION

In city smoke-abatement work it is customary to require approval of the sizing of fuel-burning equipment. This is to insure that, with reasonable attention, the equipment can be operated essentially smokelessly, having such features as ample furnace volume and air supply. To answer the many inquiries that come to the Bureau of Mines as to what dimensions are acceptable and standard, the requirements of a number of smoke-abatement ordinances have been tabulated.

CONCLUSIONS

Study of these tabulations shows that even after many years of fuel-burning practice and experience there is no common standard. Variations in the requirements for the same type of equipment under the same conditions of operation are great. This causes considerable difference in installation costs. Over-all costs being affected, the competitive positions of different types of fuel-burning equipment are also affected. It is apparent that there is a lack of information as to proper dimensions that is commonly accepted as authoritative.

DISCUSSION

Table 1 gives the minimum furnace-setting heights required by various cities for mechanical underfeed stokers installed under H.R.T. boilers. Figure 1 shows a typical installation. The dimension given for each case is the distance from the dead plate of the stoker to bottom of boiler shell, unless otherwise noted. As shown in the table, different cities use different size-classification systems; it is not possible to make complete, exact, direct comparisons. Table 1a gives a comparison for various cities, showing the approximate percentage difference in H.R.T. furnace-setting heights required from those recommended by the Stoker Manufacturers' Association arbitrarily chosen to serve as a basis of comparison. The percentages are approximate because they were calculated as if all heights as given were measured from the dead plate of the stoker. In two cases a lower height is permitted, in a number of cases the height may be the same, and in a number of cases the height must be greater. The percentage increase goes to 100 in one case. Lack of uniformity is quite evident.

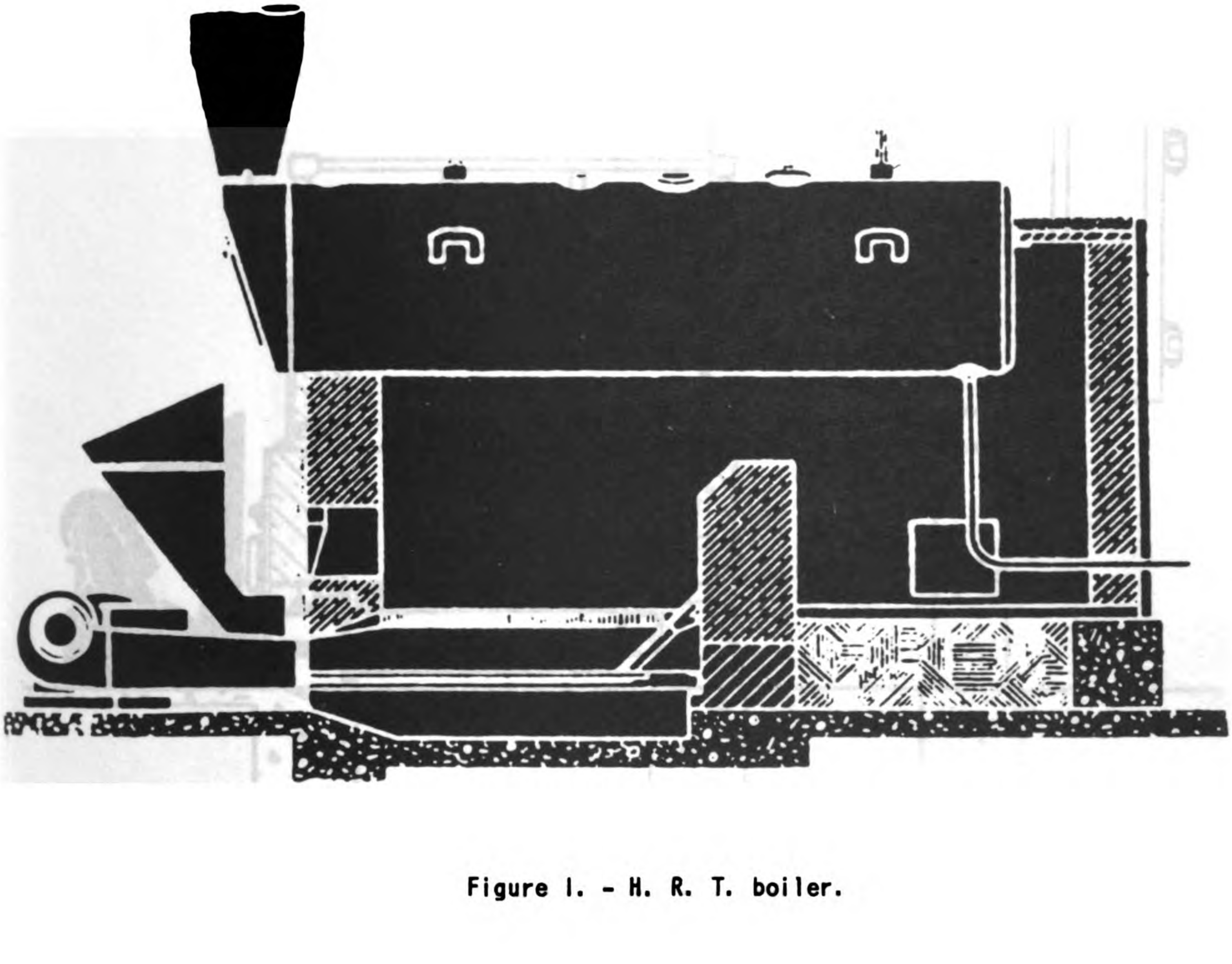

Figure 1. - H. R. T. boiler.

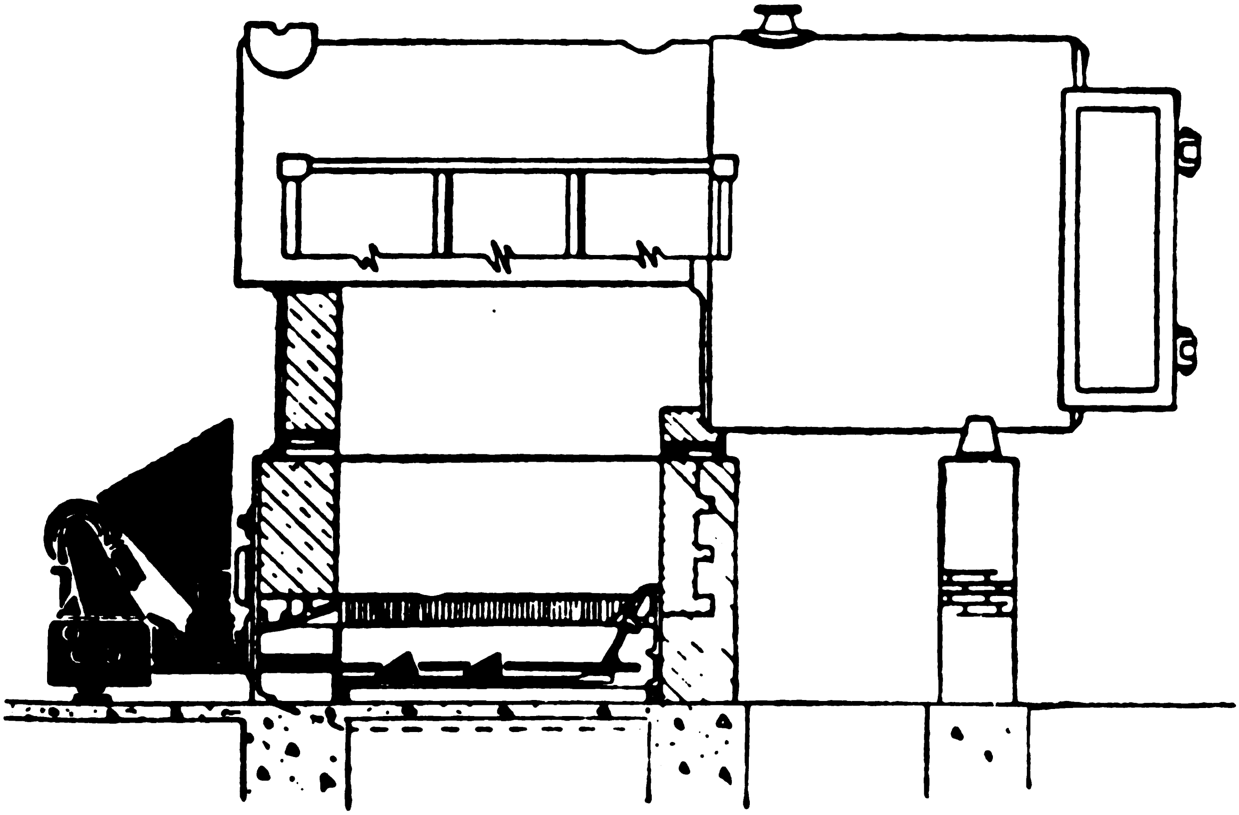

Figure 2. - Firebox-type steel boiler.

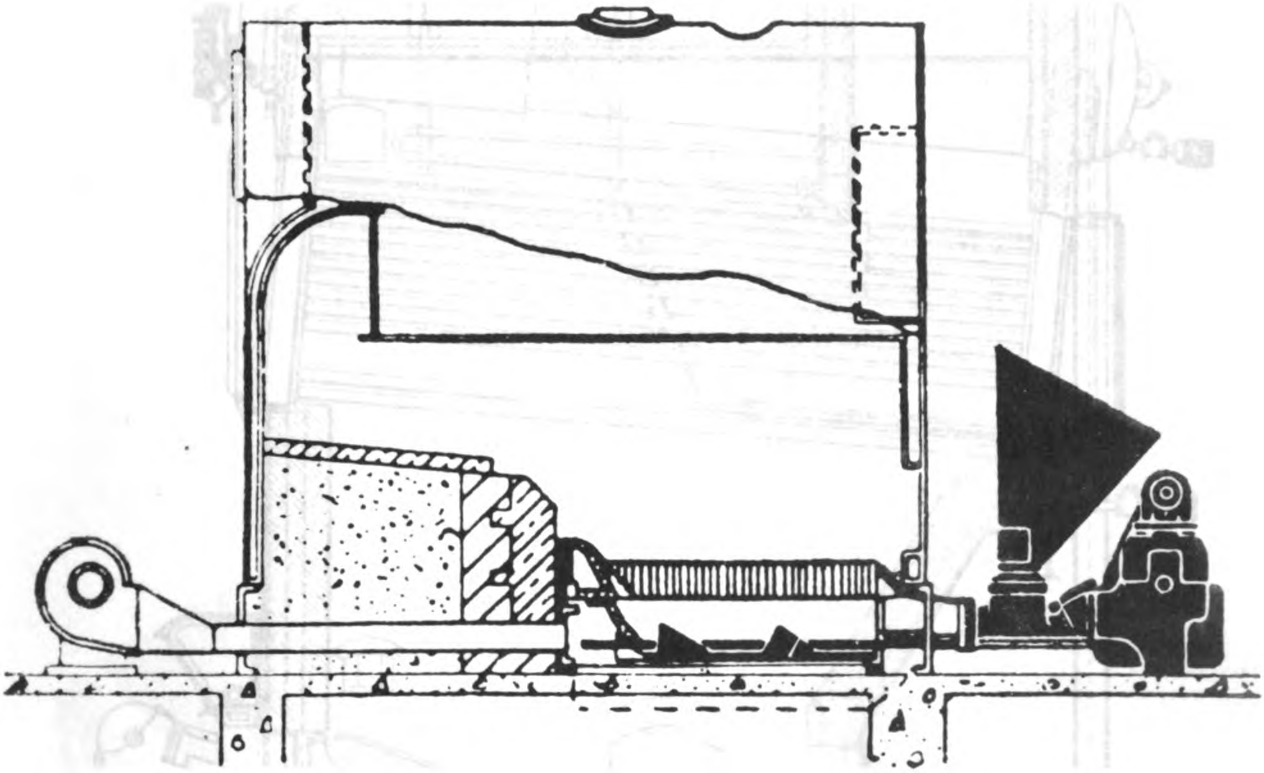

Figure 3. - Compact-type firebox boiler.

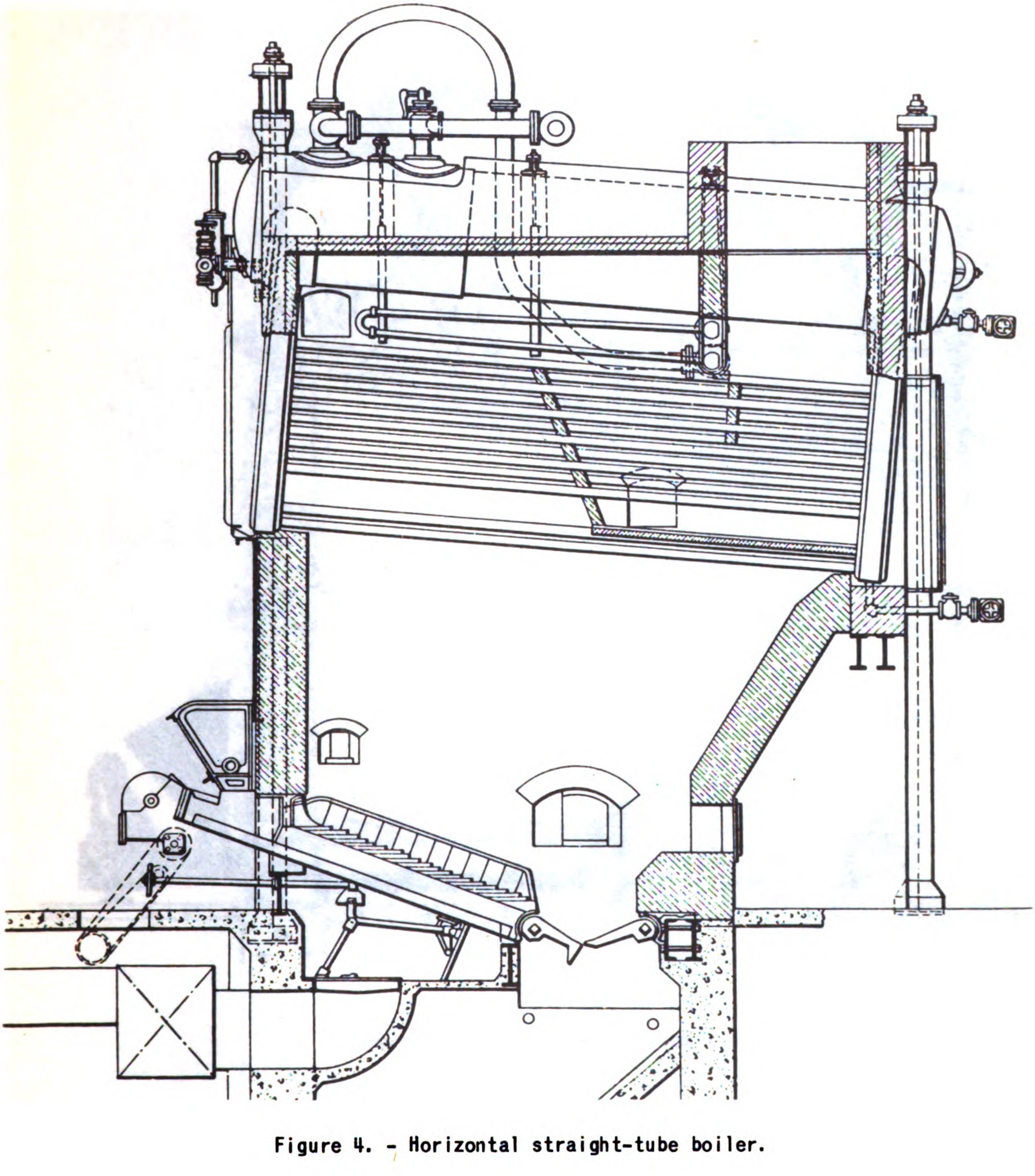

Figure 4. - Horizontal straight-tube boiler.

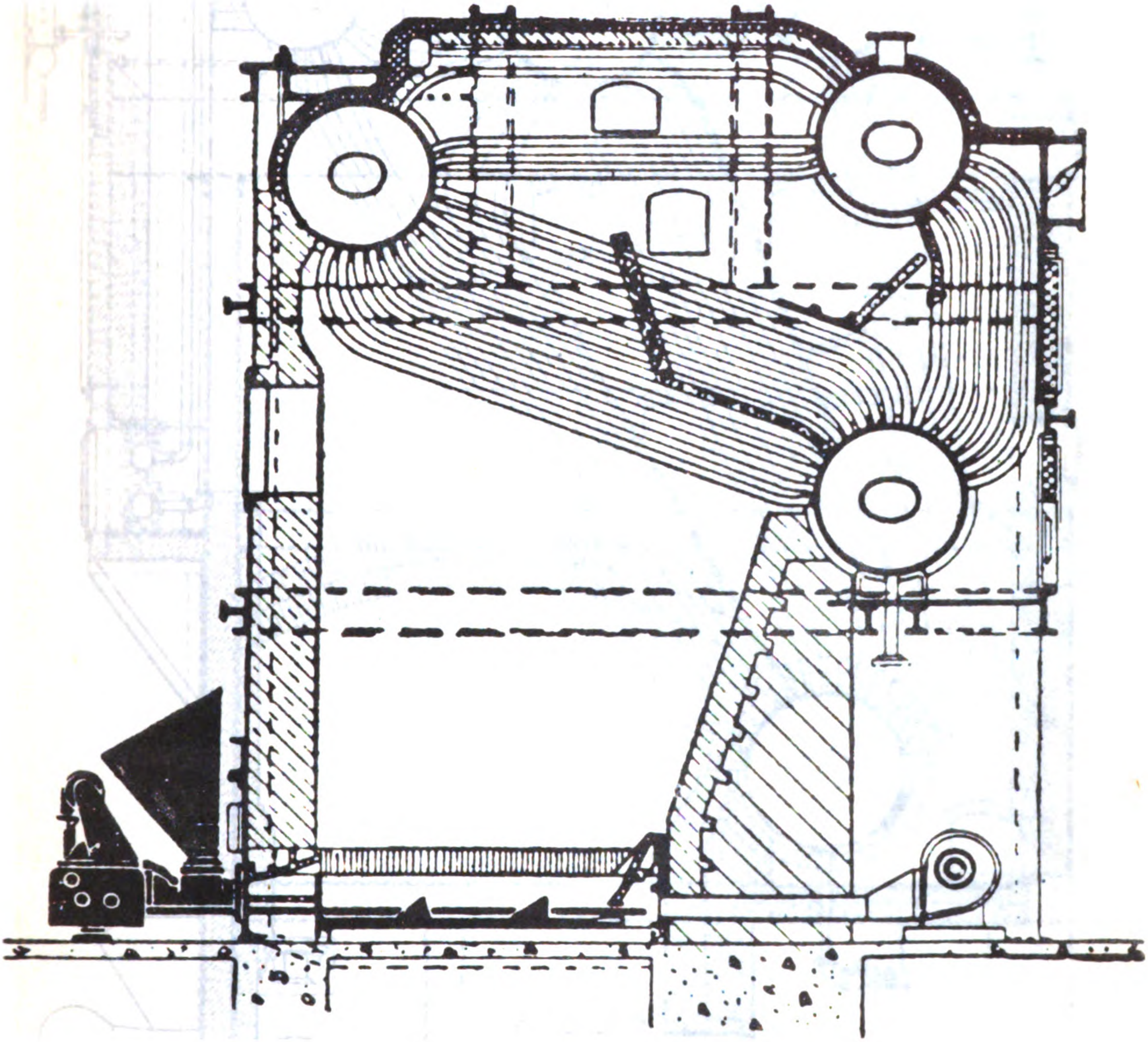

Figure 5. - Bent-tube, 3-drum boiler.

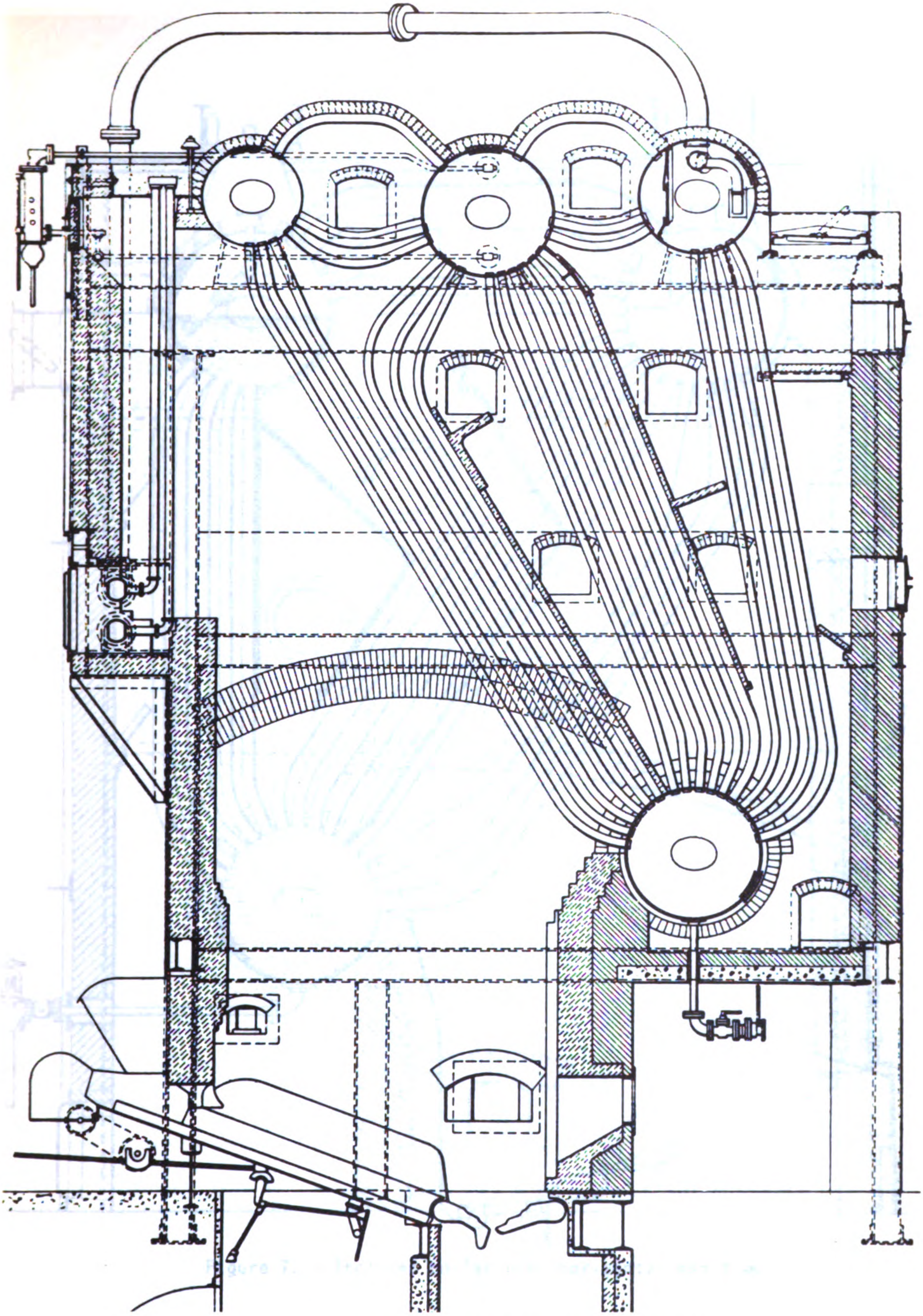

Figure 6. - Bent-tube, 4-drum boiler.

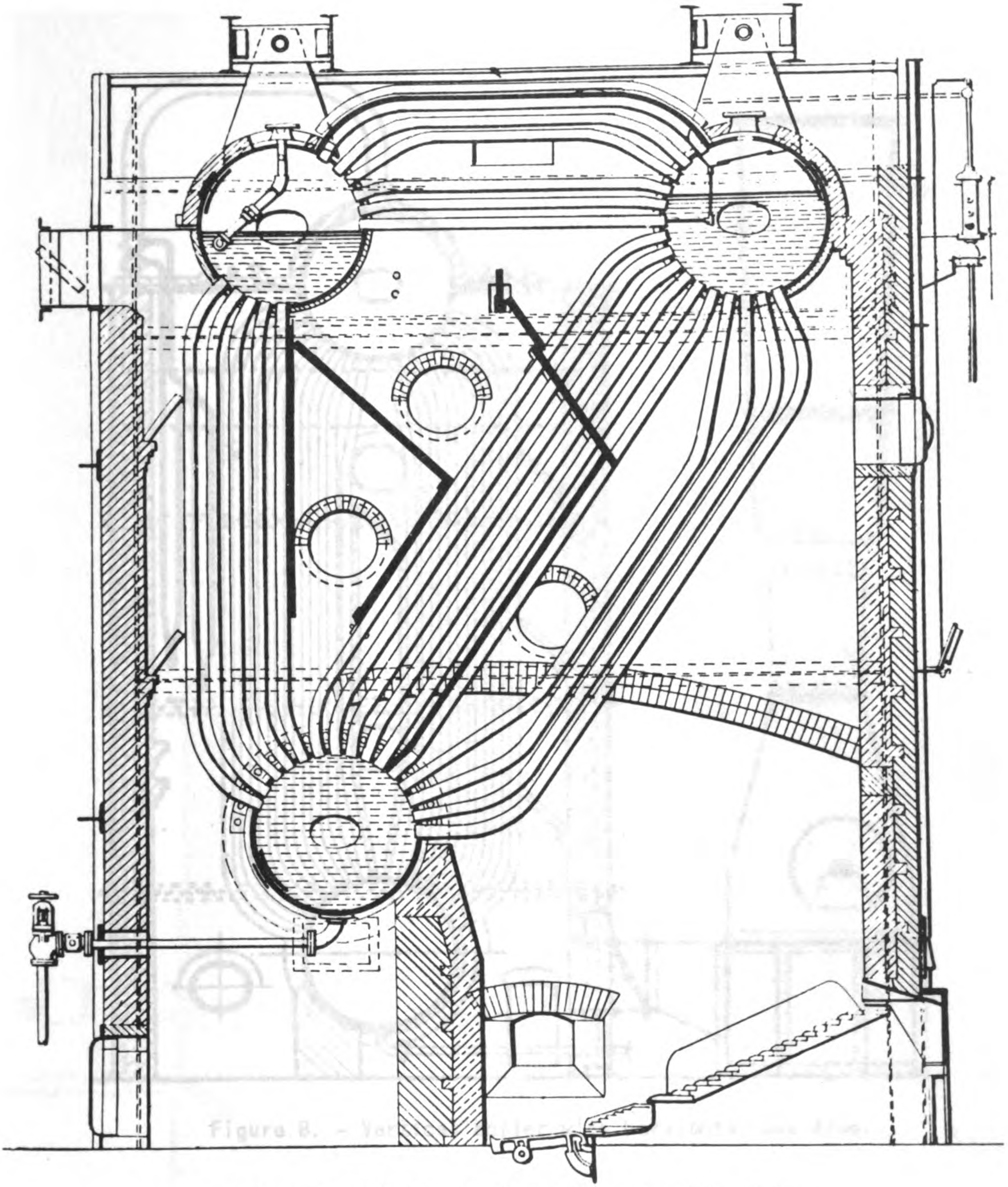

Figure 7. - Inclined boiler with horizontal mud drum.

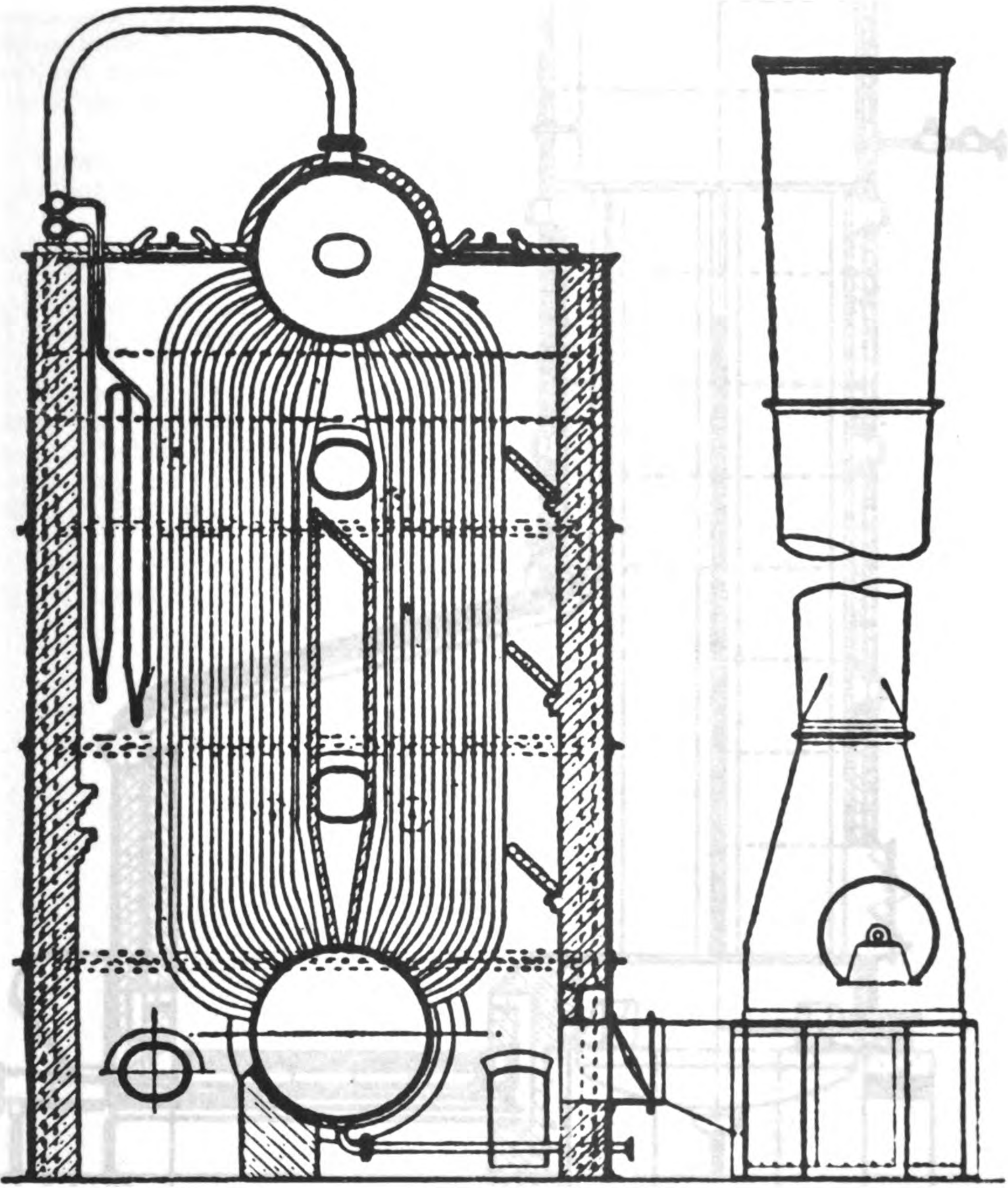

Figure 8. - Vertical boiler with horizontal mud drum.

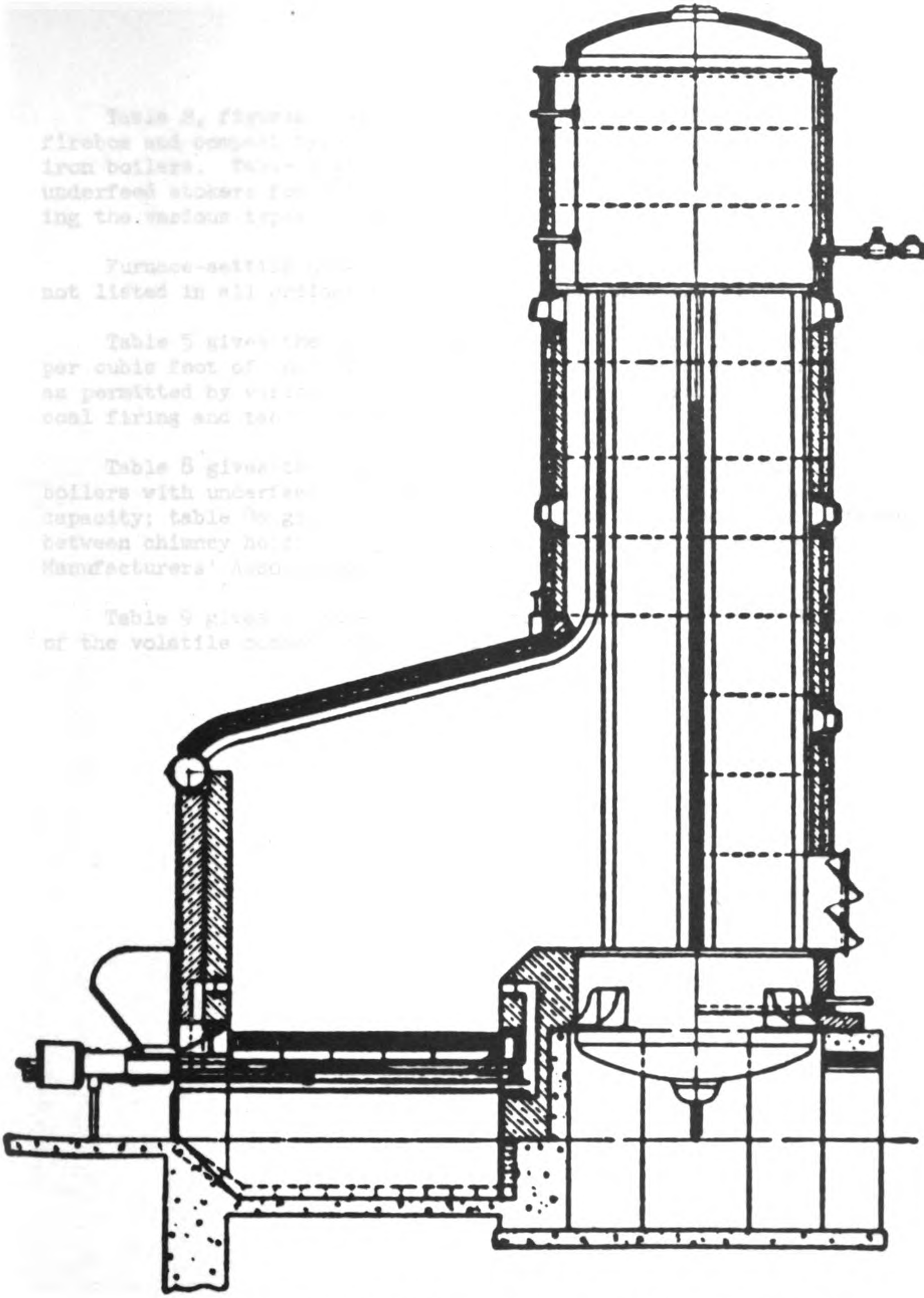

Figure 9. - Vertical boiler with a vertical mud drum.

Table 2, figures 2 and 3, and table 2a give similar information for firebox and compact types of steel boilers, and tables 3 and 3a for cast-iron boilers. Table 4 gives the furnace-setting heights required with underfeed stokers for water-tube boilers, figures 4 to 9, inclusive, showing the various types of boilers.

Furnace-setting heights such as are given for underfeed stokers are not listed in all ordinances for other types of stokers.

Table 5 gives the maximum furnace heat releases in B.t.u. per hour per cubic foot of combustion space for boilers fired by underfeed stokers, as permitted by various cities; table 6 gives the same for pulverized coal firing and table 7 for oil firing.

Table 8 gives the minimum recommended chimney sizes for heating boilers with underfeed stokers operating at manufacturer's rated capacity; table 8a gives, for various cities, the percentage difference between chimney heights required and those recommended by the Stoker Manufacturers' Association.

Table 9 gives a comparison of various ordinances as to limitation of the volatile content of coal for certain uses.

TABLE 1.--Minimum furnace setting heights, in inches, for mechanical underfeed stokers installed under H.R.T. boilers

(Dimensions are from dead plate of stoker to bottom of boiler shell unless otherwise noted.)

City, county, or organization	E.D.R. up to 2,499 sq. ft. Hp. up to 18[1]	E.D.R., 2,500-6,999 sq. ft. Hp., 18-50	E.D.R., 7,000-10,999 sq. ft. Hp., 51-80	E.D.R., 11,000-13,999 sq. ft. Hp., 81-100	E.D.R., 14,000-17,499 sq. ft. Hp., 101-125	E.D.R., 17,500-20,999 sq. ft. Hp., 126-150	E.D.R., 21,000-25,000 sq. ft. Hp., 151-175	Hp., 176-200	Hp., 201-250	20 lb. coal/hr. (5 hp.)[2]	30 lb. coal/hr. (7 hp.)	40 lb. coal/hr. (9 hp.)	50 lb. coal/hr. (12 hp.)	60 lb. coal/hr. (14 hp.)	70 lb. coal/hr. (16 hp.)	80 lb. coal/hr. (19 hp.)	90 lb. coal/hr. (21 hp.)	100 lb. coal/hr. (23 hp.)	200 lb. coal/hr. (50 hp.)[3]	400 lb. coal/hr. (100 hp.)	600 lb. coal/hr. (151 hp.)	800 lb. coal/hr. (201 hp.)	1,000 lb. coal/hr. (251 hp.)	1,200 lb. coal/hr. (301 hp.)	36 in. dia. (15-25 hp.)	48 in. dia. (45-70 hp.)	54 in. dia. (60-80 hp.)	60 in. dia. (70-120 hp.)	66 in. dia. (90-160 hp.)	72 in. dia. (125-220 hp.)	78 in. dia. (175-260 hp.)	84 in. dia. (200-300 hp.)
Atlanta, Ga.[4]	Dimensions: Minimum distance stoker ironwork to shell.																								36	48	54	60	60	60	72	72
Baltimore, Md.[5]/[6]	-	42	48	54	60	66	72	72	78																							
Birmingham, Ala.	(No dimensions specified; approval of design required.)																															
Chicago, Ill.[7]																									-	-	42	44	46	48	-	-
Cincinnati, Ohio	Dimensions: Minimum distance stoker ironwork to shell.																								36	48	54	60	60	60	72	72
Cleveland, Ohio[8]										18	19	20	21	23	24	25	26	27	30	36	42	48	54	60	-	-	-	-	-	-	-	-
Columbus, Ohio[9]	Dimensions: Top of tuyeres to shell.									18	19	-	22	-	24	-	-	27	30	36	42	48	54	60	-	-	-	-	-	-	-	-
Davenport, Iowa	(No dimensions specified; approval of design required.)																															
Denver, Colo.	(No dimensions specified; approval of design required.)																															
Detroit, Mich.[10]	Dimensions: Floor to bottom of shell.																								-	-	-	-	-	84	84	84
Hudson Co., N. J.[5]/[11]/[12]	-	42	48	54	60	66	72	72		Dimensions: Top of stoker retort to bottom of boiler shell.																						
Indiana Coal Trade Assn.																									42	48	54	60	60	60	60	60
Los Angeles Co., Calif.	(No dimensions specified; approval of design required.)																															
Louisville, Ky.	Dimensions: Minimum distance stoker ironwork to shell.																								36	48	54	60	60	60	72	72
Minneapolis, Minn.	(No dimensions specified; approval of design required.)																															
Nashville, Tenn.[9]										18	19¼	20¼	21½	22½	-	-	-	27	30	36	42	48	54	60	-	-	-	-	-	-	-	-
Philadelphia, Pa.	(No dimensions specified; approval of design required.)																															
Pittsburgh, Pa.	(No dimensions specified; approval of design required.)																															
St. Louis, Mo.	Dimensions: Minimum distance stoker ironwork to shell.									18	20	22½	24	25½	26½	27½	28	29	33	39	44	48	51½	53½	-	-	-	-	-	-	-	-
Stoker Mfg. Assn.	Dimensions correct to 0.5 inch taken from formula.									18	19	20	21	23	24	25	26	27	30	36	42	48	54	60	-	-	-	-	-	-	-	-
Toronto, Ont. Canada	Dimensions: Minimum distance stoker ironwork to shell																								36	48	54	60	60	60	60	60
Washington, D. C.[5]/[13]/[14]	-	42	48	54	60	66	72																									

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[1] Equivalent direct radiation (columns 1-9).

[2] Based on 12,000 B.t.u. coal and an over-all efficiency of 65 percent (columns 10-18).

[3] Based on 12,000 B.t.u. coal and an over-all efficiency of 70 percent (columns 19-24).

[4] When a stoker is installed under an H.R.T. boiler not originally set high enough to obtain the specified setting heights, the stoker shall be pitted a sufficient amount to obtain the required distance between the shell and stoker.

[5] Load limit 150-percent rating.

[6] The minimum setting heights of all mechanical stoker-fired H.R.T. boilers larger than those listed shall be treated as individual cases and given special consideration.

[7] The table of minimum requirements for smokeless settings shall be established, except where, owing to extraordinary conditions, the setting height shown cannot be obtained, but where adequate provision for purpose of preventing smoke is made by other means.

[8] Setting heights for all stoker installations shall be in accordance with the recommendations of the Stoker Manufacturers' Association and the American Boiler and Affiliated Industries.

[9] These dimensions are for all types of steel boilers.

[10] These measurements apply to power boilers equipped with single-retort underfeed stokers. For multiple-retort underfeed or chain-grate stokers the minimum measurement is 96 inches for 72- or 84-inch diameter H.R.T. boilers.

[11] The minimum furnace heights of all H.R.T. boilers larger than those listed, equipped with mechanical underfeed stokers, to be operated at 150-percent rating or less, shall be the preferred minimum furnace heights recommended by the Stoker Manufacturers' Association revised and amended to date.

[12] For power boilers equipped with mechanical underfeed stokers, to be operated at more than 150-percent rating, special ruling shall be obtained from the Department of Smoke Regulation.

[13] For power boilers equipped with underfeed stokers, to be operated at more than 150-percent rating, special ruling shall be obtained from the Division of Smoke Regulation and Boiler Inspection.

[14] Stokers designed for anthracite will be given special ruling.

TABLE 1a.--Furnace setting heights for H.R.T. boilers compared with Stoker Manufacturers Association recommendations, showing percentage difference for specified horsepower

City, county or Organization	Horsepower - difference + or -, in percent														
	5	7	10	12	14	17	19	21	24	50	100	150	201	252	303
Atlanta, Ga.---------------	-	-	-	-	-	+50	+44	+38	+33	+60	+67	+43	+25-+50	+33	+20
Baltimore, Md.-------------	-	-	-	-	-	-	+68	+62	+56	+40	+50	+57	+50	+44	-
Chicago, Ill.--------------	-	-	-	-	-	-	-	-	-	-	+22	+10	0	-	-
Cincinnati, Ohio-----------	-	-	-	-	-	+50	+44	+38	+33	+60	+67	+43	+25-+50	+33	+20
Cleveland, Ohio------------	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Columbus, Ohio-------------	0	0	-	+5	-	0	-	-	0	0	0	0	0	0	0
Detroit, Mich.-------------	-	-	-	-	-	-	-	-	-	-	-	+100	+75	+56	+40
Hudson Co., N. J.----------	-	-	-	-	-	-	+68	+62	+56	+40	+50	+57	+50	-	-
Indiana Coal Trade Assn.---	-	-	-	-	-	+75	+68	+62	+56	+60	+67	+43	+25	+11	0
Louisville, Ky.------------	-	-	-	-	-	+50	+44	+38	+33	+60	+67	+43	+25-+50	+33	+20
Nashville, Tenn.-----------	0	0	0	0	0	-	-	-	0	0	0	0	0	0	0
St. Louis, Mo.-------------	0	+5	+13	+14	+11	+10	+10	+8	+7	+10	+8	+5	0	-5	-11
Toronto, Ont., Canada------	-	-	-	-	-	+50	+44	+38	+33	+60	+67	+43	+25-+50	+11	0
Washington, D. C.----------	-	-	-	-	-	-	+68	+62	+56	+40	+50	+57	-	-	-

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TABLE 2.--Minimum furnace setting heights, in inches, for mechanical underfeed stokers installed under firebox1/ and compact2/ steel boilers

(Dimensions are from dead plate of stoker to crown sheet (or equivalent) unless otherwise noted)

City, county, or organization	E.D.R. to 2,499 sq. ft.3/ hp. to 18	E.D.R.,-2,500-6,999 sq. ft. hp., 18-50	E.D.R.,-7,000-10,999 sq. ft. hp., 51-80	E.D.R.,-11,000-13,999 sq. ft. hp., 81-100	E.D.R.,-14,000-17,499 sq. ft. hp., 101-125	E.D.R.,-17,500-20,999 sq. ft. hp., 126-150	E.D.R.,-21,000-25,000 sq. ft. hp., 151-175	hp., 176-200	hp., 201-250	E.D.R., 2,500-(18 hp.)	E.D.R., 5,000-(36 hp.)	E.D.R., 7,500-(54 hp.)	E.D.R., 10,000-(72 hp.)	E.D.R., 12,500-(90 hp.)	E.D.R., 15,000-(108 hp.)	E.D.R., 20,000-(143 hp.)	E.D.R., 25,000-(179 hp.)	E.D.R., 30,000-(215 hp.)	20 lb. coal/hr. (5 hp.)4/	30 lb. coal/hr. (7 hp.)	40 lb. coal/hr. (9 hp.)	50 lb. coal/hr. (12 hp.)	60 lb. coal/hr. (14 hp.)	70 lb. coal/hr. (16 hp.)	80 lb. coal/hr. (19 hp.)	90 lb. coal/hr. (21 hp.)	100 lb. coal/hr. (23 hp.)	200 lb. coal/hr. (50 hp.)5/	400 lb. coal/hr. (100 hp.)	600 lb. coal/hr. (151 hp.)	800 lb. coal/hr. (201 hp.)	1,000 lb. coal/hr. (251 hp.)	1,200 lb. coal/hr. (301 hp.)
Atlanta, Ga.	Dimensions from top point of stoker to crown sheet (or equivalent).																		18	19	20	21	23	24	25	26	27	30	36	42	48	54	60
Baltimore, Md.6/7/8/	36	42	48	54	60	66	72	For compact type heating boiler only under 15 inch gage pressure.																									
Baltimore, Md.6/7/8/	48	54	60	66	72	78	84	84	90																								
Birmingham, Ala.	(No dimensions specified; approval of design required.)																																
Chicago, Ill.	(No dimensions specified; approval of design required.)																																
Cincinnati, Ohio9/	Dimensions from top of tuyeres to crown sheet (or equivalent).																		18	19	-	22	-	24	-	-	27	30	36	42	-	-	-
Cleveland, Ohio10/																			18	19	20	21	23	24	25	26	27	30	36	42	48	54	60
Columbus, Ohio	Dimensions from top of tuyeres to crown sheet (or equivalent).																		18	19	-	22	-	24	-	-	27	30	36	42	-	-	-
Davenport, Iowa	(No dimensions specified; approval of design required.)																																
Denver, Colo.	(No dimensions specified; approval of design required.)																																
Detroit, Mich.	(No dimensions specified; approval of design required.)																																
Hudson Co., N.J.6/11/12/	36	42	48	54	60	66	72	Dimensions from top of stoker retort to crown sheet (or equivalent). For compact type boiler only.																									
Hudson Co., N.J.6/11/12/13/	48	54	60	66	72	78	84	Dimensions from top of stoker retort to crown sheet (or equivalent).																									
Indiana Coal Trade Assn.										30	33	36	42	45	48	54	60	60															
Los Angeles Co., Calif.	(No dimensions specified; approval of design required.)																																
Louisville, Ky.																			18	19	20	21	23	24	25	26	27	30	36	42	48	54	60
Minneapolis, Minn.	(No dimensions specified; approval of design required.)																																
Nashville, Tenn.14/	Dimensions from top of tuyeres to crown sheet (or equiv.)									18	19¼	20¼	21½	22½					-	-	-	-	-	-	-	-	27	30	36	42	48	54	60
Philadelphia, Pa.	(No dimensions specified; approval of design required.)																																
Pittsburgh, Pa.	(No dimensions specified; approval of design required.)																																
St. Louis, Mo.14/15/16/	Dimensions from top of tuyeres to crown sheet (or equivalent).																		18	20	22½	24	25½	26½	27½	28	29	33	39	44	48	51½	53½
Stoker Mfg. Assn.	Dimensions correct to 0.5 inch taken from formula																		18	19	20	21	23	24	25	26	27	30	36	42	48	54	60
Toronto, Ont., Canada	Dimensions from top of tuyere to crown sheet (or equivalent).																		18	19	20	21	23	24	25	26	27	30	36	42	48	54	60
Washington, D. C.8/17/18/	36	42	48	54	60	66	72	For compact type boiler only.																									
Washington, D. C.8/17/18/	48	54	60	66	72	78	84																										

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[1] The firebox-type boiler, as used above, is a two-pass unit arranged so that the products of combustion enter the front end of the lower bank of tubes, flow to the rear, and are then redirected to the front through the upper bank of tubes and discharged through the flue opening at the front end of the boiler.

[2] The compact-type boiler, as used above, is a two-pass unit, also, but is designed so that the gases flow to the rear of the boiler before entering the lower bank of tubes, through which they are directed to the front of the boiler, then reversed in direction to the upper bank, and discharged through the flue opening at the rear of the boiler.

[3] Equivalent direct radiation (columns 1-9).

[4] Based on 12,000 B.t.u. coal and an over-all efficiency of 65 percent (columns 10-18).

[5] Based on 12,000 B.t.u. coal and an over-all efficiency of 70 percent (columns 19-33).

[6] Load limit, 125-percent rating.

[7] The minimum setting heights of all internally fired boilers larger than those listed in the table and equipped with mechanical stokers shall be treated as individual cases and given special consideration.

[8] Stokers designed for anthracite will be given special ruling.

[9] For boilers with drop arch or smokeless arch sections, the height from the top of the tuyere to the drop arch, if the arch is in front or above bridge wall, shall be not less than two-thirds the height required in the table.

[10] Water grates on all steel down-draft boilers shall be removed when stokers or oil burners are installed. The water tube nearest each side of the firebox may be left intact.

[11] Down-draft boilers must have all water grates removed.

[12] For power boilers equipped with mechanical underfeed stokers to be operated at more than 150 percent rating, special ruling shall be obtained from the Department of Smoke Regulation. Design of all mechanical underfeed-stoker installations shall be submitted to the Department of Smoke Regulation for approval.

[13] The minimum furnace heights of internally fired (firebox) boilers larger than those listed in the table, equipped with mechanical underfeed stokers, to be operated at 150 percent rating or less, shall be the preferred minimum furnace heights recommended by the Stoker Manufacturers' Association, revised and amended to date.

[14] Boilers having a drop arch from the top of the furnace and a distance less than 18 inches in a horizontal direction of gas flow from the nearest margin of the tuyeres shall have a clear height from the top of the tuyeres to the drop arch that shall not be less than 66-2/3 percent of the required clear height in the furnace.

[15] All the tubes of down-draft grates in steel boilers shall be removed except two tubes on each side of the furnace, which may be left in place; otherwise, the clear height shall be taken to the bottom of the water grate.

[16] Drums in steel down-draft boilers from which the tubes have been removed shall not be considered as obstructions, provided that there is an open space across the furnace between the drum and the crown sheet or shell.

[17] On down-draft boilers the water grates shall be considered the equivalent of the crown sheet, unless they are removed.

[18] For power boilers equipped with underfeed stokers, to be operated at more than 150 percent rating, special ruling shall be obtained from the Division of Smoke Regulation and Boiler Inspection.

TABLE 2a.--Furnace setting heights for internally fired steel boilers compared with Stoker Manufacturers Association recommendations, showing percentage difference for specified horsepower

City, county, or organization	Horsepower - difference + or -, in percent														
	5	7	10	12	14	17	19	21	24	50	100	150	201	252	303
Atlanta, Ga.-------------------	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Baltimore, Md.-----------------	+167 +100	+153 +90	+140 +80	+129 +71	+109 +57	+100 +50	+116 +68	+108 +62	+100 +56	+80 +40	+83 +50	+86 +57	+75 -	+67	Firebox type Compact type
Cincinnati, Ohio---------------	0	0	-	+5	-	0	-	-	0	0	0	0	-	-	-
Cleveland, Ohio----------------	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Columbus, Ohio-----------------	0	0	-	+5	-	0	-	-	0	0	0	0	-	-	-
Hudson Co., N. J.--------------	+167 +100	+153 +90	+140 +80	+129 +71	+109 +57	+100 +50	+116 +68	+108 +62	+100 +56	+80 +40	+83 +50	+86 +57	Firebox Type Compact Type		
Indiana Coal Trade Assn.-------	-	-	-	-	-	-	+20	-	-	+20	+33	+29	+25	-	-
Louisville, Ky.----------------	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Nashville, Tenn.---------------	0	0	0	0	0	-	-	-	0	0	0	0	0	0	-
St. Louis, Mo.-----------------	0	+5	+13	+14	+11	+10	+10	+8	+7	+10	+8	+5	0	-5	-11
Toronto, Ont., Canada----------	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Washington, D. C.--------------	+167 +100	+153 +90	+140 +80	+129 +71	+109 +57	+100 +50	+116 +68	+108 +62	+100 +56	+80 +40	+83 +50	+86 +57	- -	Firebox type Compact type	

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TABLE 3.--Minimum furnace setting heights, in inches, for mechanical underfeed stokers installed under cast-iron boilers

(Dimensions are from dead plate of stoker to nearest heating surface forming the equivalent of a crown sheet unless otherwise noted.)

City, county, or organizations	E.D.R., to 2,499 sq. ft.[1] Hp., to 18	E.D.R., 2,500-6,999 sq. ft. Hp., 18-50	E.D.R., 7,000-10,999 sq. ft. Hp., 51-80	E.D.R., 11,000-13,999 sq. ft. Hp., 81-100	E.D.R., 14,000-17,499 sq. ft. Hp., 101-125	E.D.R., 17,500-20,999 sq. ft. Hp., 126-150	E.D.R., 21,000-25,000 sq. ft. Hp., 151-175 Hp., 176-200 Hp., 201-250	E.D.R., 2,500 (18 hp.)	E.D.R., 5,000 (36 hp.)	E.D.R., 7,500 (54 hp.)	E.D.R., 10,000 (72 hp.)	E.D.R., 12,500 (90 hp.)	E.D.R., 15,000 (108 hp.)	E.D.R., 20,000 (143 hp.)	E.D.R., 25,000 (179 hp.)	E.D.R., 30,000 (215 hp.)	20 lb. coal/hr. (5 hp.) [2]	30 lb. coal/hr. (7 hp.)	40 lb. coal/hr. (9 hp.)	50 lb. coal/hr. (12 hp.)	60 lb. coal/hr. (14 hp.)	70 lb. coal/hr. (16 hp.)	80 lb. coal/hr. (19 hp.)	90 lb. coal/hr. (21 hp.)	100 lb. coal/hr. (23 hp.)	200 lb. coal/hr. (50 hp.) [3]	400 lb. coal/hr. (100 hp.)	600 lb. coal/hr. (151 hp.)	800 lb. coal/hr. (201 hp.)	1000 lb. coal/hr. (251 hp.)	1200 lb. coal/hr. (301 hp.)
Atlanta, Ga.	Dimensions from top point of stoker to center of heating surface forming the equivalent of a crown sheet.																16	17	18	19	20	21	22	23	24	26	32	37	42	47	53
Baltimore, Md.[4][5]	36	42	48	54																											
Birmingham, Ala.	(No dimensions specified; approval of design required.)																														
Chicago, Ill.	(No dimensions specified; approval of design required.)																														
Cincinnati, Ohio[6]	Dimensions from top of tuyeres to center of heating surface forming the equivalent of a crown sheet.																18	19	-	22	-	24	-	-	27	30	36	42	-	-	-
Cleveland, Ohio[7]																	16	17	18	19	20	21	22	23	24	26	32	37	42	47	53
Columbus, Ohio	Dimensions from top of tuyeres to center of heating surface forming the equivalent of a crown sheet.																18	19	-	22	-	24	-	-	27	30	36	42	-	-	-
Davenport, Iowa	(No dimensions specified; approval of design required.)																														
Denver, Colo.	(No dimensions specified; approval of design required.)																														
Detroit, Mich.	(No dimensions specified; approval of design required.)																														
Hudson Co., N. J.[8]	36	42	48	54	Dimensions from top of stoker retort to nearest heating surface of boiler not in a vertical plane.																										
Indiana Coal Trade Assn.								30	33	36	42	45	48	54	60	60															
Los Angeles Co., Calif.	(No dimensions specified; approval of design required.)																														
Louisville, Ky.																	16	17	18	19	20	21	22	23	24	26	32	37	42	47	53
Minneapolis, Minn.	(No dimensions specified; approval of design required.)																														
Nashville, Tenn.[9][10]	Dimensions from top of tuyeres to center of heating surface forming the equivalent of a crown sheet.																18	19¼	20¼	21½	22½	-	-	-	27	30	36	42	48	54	60
Philadelphia, Pa.	(No dimensions specified; approval of design required.)																														
Pittsburgh, Pa.	(No dimensions specified; approval of design required.)																														
St. Louis, Mo.[9][10]	Dimensions from top of tuyeres to center of heating surface forming the equivalent of a crown sheet.																18	20	22½	24	25½	26½	27½	28	29	33	39	44	48	51½	53½
Stoker Mfgs. Assn.	Dimensions correct to 0.5 inch taken from formula.																16	17	18	19	20	21	22	23	24	26	32	37	42	47	53
Toronto, Ont., Canada	Dimensions from top of tuyeres to nearest heating surface forming the equivalent of a crown sheet.																16	17	18	19	20	21	22	23	24	26	32	37	42	47	53
Washington, D. C.[5]	36	42	48	54	60	66																									

[1] Equivalent direct radiation (columns 1-18).

[2] Based on 12,000 B.t.u. coal and an over-all efficiency of 65 percent (columns 19-27).

[3] Based on 12,000 B.t.u. coal and an over-all efficiency of 70 percent (columns 28-33).

[4] The minimum setting heights of all internally fired boilers, larger than those listed in the table and equipped with mechanical stokers, shall be treated as individual cases and given special consideration.

[5] Stokers designed for anthracite will be given special ruling.

[6] For boilers with drop arch or smokeless arch sections, the height from the top of the tuyere to the drop arch, if the arch is in front or above bridge wall, shall be not less than two-thirds the height required in the table.

[7] On cast-iron down-draft boilers, normal setting heights between water grates and stoker will be required, except with approval of the chief.

[8] Water grates must be removed from all down-draft boilers.

[9] The clear height shall be measured to the bottom of the water grate for cast-iron down-draft boilers.

[10] Boilers having a drop arch from the top of the furnace and a distance less than 18 inches in a horizontal direction of gas flow from the nearest margin of the tuyeres shall have a clear height from the top of the tuyeres to the drop arch, which shall not be less than 66-2/3 percent of the required clear height in the furnace.

TABLE 3a.--Furnace setting heights for cast-iron boilers compared with Stoker Manufacturers Association recommendations, showing percentage difference for specified horsepower

City, county or organization	Horsepower - difference + or -, in percent														
	5	7	10	12	14	17	19	21	24	50	100	150	201	252	303
Atlanta, Ga.------------------	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Baltimore, Md.----------------	+125	+112	+100	+90	+80	+71	+91	+83	+75	+62	+69	-	-	-	-
Cincinnati, Ohio--------------	+13	+12	-	+16	-	+14	-	-	+13	+15	+13	+14	-	-	-
Cleveland, Ohio---------------	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Columbus, Ohio----------------	+13	+12	-	+16	-	+14	-	-	+13	+15	+13	+14	-	-	-
Hudson Co., N. J.-------------	+125	+112	+100	+90	+80	+71	+91	+83	+75	+62	+69	-	-	-	-
Indiana Coal Trade Assn.------	-	-	-	-	-	-	+36	-	-	+38	+50	+49	+40	-	-
Louisville, Ky.---------------	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Nashville, Tenn.--------------	+13	+13	+13	+13	+13	-	-	-	+13	+15	+13	+14	+14	+15	+13
St. Louis, Mo.----------------	+13	+18	+25	+26	+28	+26	+25	+22	+21	+27	+22	+19	+14	+10	+1
Toronto, Ont., Can.-----------	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Washington, D. C.-------------	+125	+112	+100	+90	+80	+71	+91	+83	+75	+62	+69	+78	-	-	-

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TABLE 4. - Minimum furnace setting heights, in feet, for underfeed stokers under water tube boilers

City, county, or organization	Horizontal straight tube		Bent tube, 3-drum, or any type in which slope of lower tubes is less than 30° from the horizontal		Bent tube, 4-drum, or any type in which slope of lower tubes is more than 30° from the horizontal		Inclined, with horizontal mud drum		Inclined, with a vertical mud drum		Vertical, with a horizontal mud drum		Vertical, with a vertical mud drum, 150 hp.		Vertical, with a vertical mud drum, 250 hp.		Vertical, with a vertical mud drum, 500 hp.		Horizontal baffling tube, pitch 1-1-1/2 inches	Vertical baffling tube, pitch 1-1-1/2 inches	Horizontal baffling tube, pitch 3-1/2 inches	Vertical baffling tube, pitch 3-1/2 inches	Horizontal, horizontally baffled, up to 18 hp.	Horizontal, horizontally baffled, 18 to 50 hp.	Horizontal, horizontally baffled, 51 to 80 hp.	Horizontal, horizontally baffled, 81 to 100 hp.	Horizontal, horizontally baffled, 101 to 125 hp.	Horizontal, horizontally baffled, 126 to 150 hp.	Horizontal, horizontally baffled, 151 to 175 hp.	Horizontal, vertically baffled, up to 18 hp.	Horizontal, vertically baffled, 18 to 50 hp.	Horizontal, vertically baffled, 51 to 80 hp.	Horizontal, vertically baffled, 81 to 100 hp.	Horizontal, vertically baffled, 101 to 125 hp.	Horizontal, vertically baffled, 126 to 150 hp.	Horizontal, vertically baffled, 151 to 175 hp.
	Min.	P.M.	Min.	P.M.	Min.	P.M.	Min.	P.M.	Min.	P.M.	Min.	P.M.	Min.	P.M.	Min.	P.M.	Min.	P.M.																		
Atlanta, Ga.1/	7		6		5																															
Baltimore, Md.																								3	3.5	2/4.5	2/5	2/5.5	2/6	2/4	2/4.5	2/5	2/5.5	2/6	2/6.5	2/7
Birmingham, Ala.3/																																				
Chicago, Ill.4/																			6.5	8.5	7.5	9														
Cincinnati, Ohio1/	7		6		5																															
Cleveland, Ohio5/																																				
Columbus, Ohio																																				
Davenport, Iowa3/																																				
Denver, Colo.3/																																				
Detroit, Mich.6/	7/10	7/12					8/6	8/8	8/5	8/6	8/3	8/4	9/4.5	9/5	9/5.5	9/6	9/6	9/6.5																		
Hudson Co., N. J.10/																																				
Indiana Coal Trade Assn.11/	7.5		7.5		7.5																															
Los Angeles Co., Calif.3/																																				
Louisville, Ky.3/																																				
Minneapolis, Minn.3/																																				
Nashville, Tenn.3/																																				
Philadelphia, Pa.3/																																				
Pittsburgh, Pa.3/																																				
St. Louis, Mo.3/																																				
Stoker Mfg. Assn.	(No dimensions specified)																																			
Toronto, Ont., Canada20/	6		6		5																															
Washington, D. C.6,12,13,14/	15/9	15/11					16/6.5	16/8.5	17/5	17/7	18/3.5	18/5	19/4.5	19/5	19/5.5	19/6	19/6	19/6.5					2/3	2/3.5	2/4	2/4.5	2/5	2/5.5	2/6	2/4	2/4.5	2/5	2/5.5	2/6	2/6.5	2/7

Min. = Minimum.
P.M. = Preferred Minimum.

1/ Dimensions are from the top of the stoker iron work to the nearest heating surface of the boiler proper.
2/ Dimensions are from stoker dead plate (or dump grate) to the nearest heating surface of the boiler proper.
3/ No dimensions specified; approval of design required.
4/ Dimensions are from front header to floor.
5/ Setting heights for all stoker installations shall be in accordance with the recommendations of the Stoker Manufacturers Association and the American Boiler and Affiliated Industries.
6/ Dimensions are for single-retort underfeed stoker.
7/ Dimensions are from floor to bottom of front header.
8/ Dimensions are from floor to center line of lower drum.
9/ Dimensions are from floor to center line of tube sheet of lower drum.
10/ Setting heights shall be in accordance with the recommendations of the Stoker Manufacturers Association.
11/ Dimensions are from the grate to the nearest point on the boiler where the gases enter between the boiler tubes.
12/ For power boilers equipped with underfeed stokers, to be operated at more than 150 percent rating, special ruling shall be obtained from the Division of Smoke Regulation and Boiler Inspection.
13/ Load limit 150 percent rating.
14/ Horizontal water-tube heating boilers in sizes up to 25,000 square feet of steam radiation shall, when horizontally baffled, have the same setting heights as compact-type boilers; when vertically baffled they shall have the same setting heights as firebox-type boilers.
15/ Dimensions are from floor line to bottom of header above stoker; for boilers above 175 hp. to be operated up to 150 percent rating.
16/ Dimensions are from floor line to center of mud drum; to be operated up to 150 percent rating.
17/ Dimensions are from floor line to top of mud drum; to be operated up to 150 percent rating.
18/ Dimensions are from floor line to center of mud drum; to be operated up to 150 percent rating.
19/ Dimensions are from floor line to top of mud drum; to be operated up to 150 percent rating.
20/ Dimensions are from the top of the stoker iron work to the nearest heating surface of the boiler proper, measured in the direction of gas flow.

TABLE 5.—Maximum heat release in B.t.u. per hour per cubic foot of combustion space for boilers fired by underfeed stokers

Atlanta, Ga.	50,000	
Baltimore, Md.		
Birmingham, Ala.		
Chicago, Ill.	50,000	
Cincinnati, Ohio	45,000	For boilers with refractory walls not air- or water-cooled, and for firebox-type boilers under 1,000 square feet.
	40,000	Firebox-type boilers.
Cleveland, Ohio		
Columbus, Ohio	45,000	Firebox-type boilers in which water leg forms at least 80 percent of side and rear walls.
	60,000	All other.
Davenport, Iowa		
Denver, Colo.		
Detroit, Mich.	33,600	
Hudson Co., N. J.		
Indiana Coal Trade Assn.		
Los Angeles Co., Calif.	50,000	
Louisville, Ky.	35,000	
Minneapolis, Minn.		
Nashville, Tenn.[1]	52,000	(about). For stokers up to 1,200 pounds per hour (or 4 pounds coal per hour).
	65,000	(about). With approved overfire air (or 5 pounds coal per hour).
Philadelphia, Pa.		
Pittsburgh, Pa.		
St. Louis, Mo.[1]	52,000	(about). For domestic and semi-industrial stokers (or 4 pounds coal per hour).
	65,000	(about). With approved overfire air (or 5 pounds coal per hour).
Stoker Mfg. Assn.	60,000	
Toronto, Ont., Canada	45,000	Firebox-type boilers in which water leg forms at least 80 percent of side and rear walls.
	50,000	Other.
Washington, D. C.		

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[1] Based on 13,000 B.t.u. per pound coal.

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TABLE 6.—Maximum heat release per hour per cubic foot of combustion space for pulverized coal firing

Atlanta, Ga.	
Baltimore, Md.[1]	20,000
Birmingham, Ala.	
Chicago, Ill.	16,667
Cincinnati, Ohio	45,000 for boilers with refractory walls not air- or water-cooled.
Cleveland, Ohio	
Columbus, Ohio	60,000
Davenport, Iowa	
Denver, Colo.	
Detroit, Mich.	
Hudson Co., N. J.[1]	20,000
Indiana Coal Trade Assn. [2]	Not less than 3 cubic feet per rated horsepower.
Los Angeles Co., Calif.	
Louisville, Ky.[3]	35,000
Minneapolis, Minn.	
Nashville, Tenn.	
Philadelphia, Pa.	
Pittsburgh, Pa.	
St. Louis, Mo.	
Toronto, Ont., Can.	
Washington, D. C.[1]	20,000

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[1] For all boilers up to 500 horsepower and having refractory walls. For larger boilers and other types of walls, maximum heat liberation shall be determined for each individual case.

[2] Calculating from the basis of a boiler efficiency of 80 percent and the necessity of developing more B.t.u. in the furnace than is obtained in the steam (33,472 B.t.u.), a B.t.u. release of 41,840 in the furnace per boiler horsepower developed would be required; this value divided by 3 would result in a furnace release per cubic foot of 13,947 B.t.u. when the boiler is operated at 100 percent of rating; at 200 percent of rating, the B.t.u. per cubic foot of furnace volume would be 27,894.

[3] Heat release rates in excess of 35,000 B.t.u. per cubic foot per hour, in general, will not be approved.

TABLE 7.—Maximum heat release per hour per cubic foot of combustion space for oil firing

Atlanta, Ga.[1]	45,000	
Baltimore, Md.[2]	30,000	
Birmingham, Ala.		
Chicago, Ill.	33,333	
Cincinnati, Ohio[3]	45,000	
Cleveland, Ohio		
Columbus, Ohio	45,000	
Davenport, Iowa		
Denver, Colo.		
Detroit, Mich.[4]	22,300	about
Hudson Co., N. J.[5]	25,000	heating boilers; 30,000 other
Indiana Coal Trade Assn.		
Los Angeles Co., Calif.	40,000	
Louisville, Ky.		
Minneapolis, Minn.		
Nashville, Tenn.		
Philadelphia, Pa.		
Pittsburgh, Pa.		
St. Louis, Mo.[1]	45,000	
Toronto, Ont., Can.		
Washington, D. C.[2]	25,000	heating boilers; 30,000 other

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[1] Calculated from the basis of 3 cubic feet per gallon of oil.

[2] For boilers up to 500 horsepower. For specially designed boilers, the combustion space shall be determined according to the individual design of the equipment.

[3] For all heating equipment containing less than 1,000 square feet of heating surface and for larger units having refractory settings neither air- nor water-cooled.

[4] Calculated from the basis of 1.5 cubic feet per rated horsepower.

[5] For boilers up to 500 horsepower and having refractory walls. For specially designed boilers the combustion space shall be determined according to the individual design of the equipment.

TABLE 8a.--Chimney specification for heating boilers compared with Stoker Mfg. recommendations, showing percent difference.

City, county, or organization	Steam radiation [1]																	
	500 sq. ft.			1,000 sq. ft.			1,500 sq. ft.			2,000 sq. ft.			2,500 sq. ft.			3,000 sq. ft.		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Atlanta, Ga.	+78	0	0	+51	+57	+0	+40	+125	0	+77	+125	+13	+20	+24	+11	+48	+50	+22
Baltimore, Md.	0	0	0	+44	0	0	0	+57	+12	+37	+125	+12	0	0	0	+20	0	+11
Birmingham, Ala.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chicago, Ill.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cincinnati, Ohio	0	0	0	-13	-30	0	0	0	0	0	+57	0	0	-30	0	0	0	+11
Cleveland, Ohio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Columbus, Ohio	+78	0	0	+51	+57	0	+40	+125	0	+77	+125	+13	+20	+24	+11	+48	+50	+22
Davenport, Iowa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Denver, Colo.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Detroit, Mich.	-21	-37	-14	-24	-30	0	-21	0	0	+5	+57	+13	-36	-30	0	-14	-21	+11
Hudson County, N. J.	+78	+43	0	+51	+57	0	+40	+125	+13	+77	+125	+25	+20	+24	+22	+48	+50	+33
Indiana Coal Trade Assn.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Los Angeles Co., Calif.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Louisville, Ky.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minneapolis, Minn.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nashville, Tenn.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Philadelphia, Pa.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pittsburgh, Pa.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
St. Louis, Mo.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toronto, Ont., Canada	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Washington, D. C.	+78	0	0	+51	+57	0	+40	+125	0	+77	+125	+13	+20	+24	+11	+48	+50	+22

City, county, or organization	Steam radiation [1]														
	4,000 sq. ft.			5,000 sq. ft.			6,000 sq. ft.			7,000 sq. ft.			8,000 sq. ft.		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Atlanta, Ga.	+36	+44	+20	+31	+69	+9	+40	+62	+8	+26	+36	+8	+36	+56	+8
Baltimore, Md.	0	0	+10	0	+21	0	+40	+19	+8	+17	0	+8	+36	+27	0
Birmingham, Ala.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chicago, Ill.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cincinnati, Ohio	-17	0	0	0	0	0	+19	0	0	0	0	+8	+17	0	0
Cleveland, Ohio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Columbus, Ohio	+36	+44	+20	+31	+69	+9	+40	+62	+8	+26	+36	+8	+36	+56	+8
Davenport, Iowa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Denver, Colo.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Detroit, Mich.	-10	-19	0	-9	0	0	-17	0	0	-17	0	+8	0	+17	+8
Hudson County, N. J.	+61	+44	+30	+31	+82	+13	+40	+51	+17	+36	+56	+17	+56	+89	+15
Indiana Coal Trade Assn.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Los Angeles Co., Calif.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Louisville, Ky.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minneapolis, Minn.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nashville, Tenn.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Philadelphia, Pa.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pittsburgh, Pa.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
St. Louis, Mo.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toronto, Ont., Canada	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Washington, D. C.	+36	+44	+20	+31	+69	+9	+40	+62	+8	+26	+36	+8	+36	+56	+8

City, county, or organization	Steam radiation [1]														
	9,000 sq. ft.			10,000 sq. ft.			11,000 sq. ft.			12,000 sq. ft.			15,000 sq. ft.		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Atlanta, Ga.	+23	+14	+8	+40	+28	+15	-	-	-	+59	+60	+15	+27	+24	+14
Baltimore, Md.	+23	-19	0	+23	-19	0	-	-	-	-	-	-	-	-	-
Birmingham, Ala.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chicago, Ill.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cincinnati, Ohio	+8	-19	0	+23	-19	0	-	-	-	-	-	-	-	-	-
Cleveland, Ohio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Columbus, Ohio	+23	+14	+8	+40	+28	+15	-	-	-	+59	+60	+15	+27	+24	+14
Davenport, Iowa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Denver, Colo.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Detroit, Mich.	-8	-13	+15	-8	-13	+23	-8	-13	+31	-8	-13	+31	-34	-30	+29
Hudson County, N. J.	+23	+21	+15	+40	+21	+15	+59	+44	+23	+59	+44	+23	+27	+12	+21
Indiana Coal Trade Assn.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Los Angeles Co., Calif.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Louisville, Ky.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minneapolis, Minn.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nashville, Tenn.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Philadelphia, Pa.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pittsburgh, Pa.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
St. Louis, Mo.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toronto, Ont., Canada	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Washington, D. C.	+23	+14	+8	+40	+28	+15	-	-	-	+59	+60	+15	+27	+24	+14

Column 1= Actual inside area of rectangular flue, in square inches.
Column 2= Actual inside area of round flue, in square inches.
Column 3= Height, in feet, above grate.

[1] In the absence of explanation radiation is assumed to be equivalent direct radiation.

TABLE 9.—City, county, or organization limitations on volatile content of bituminous coal for certain uses

Atlanta, Ga. None. (Limitations on the use of bituminous coal in specific types of equipment.)
Baltimore, Md.[1] 23% (dry basis), with qualifications.
Birmingham, Ala.[2]
Chicago, Ill.[3] 20% (dry basis), with qualifications.
Cincinnati, Ohio[4] 26% (dry basis), with qualifications.
Cleveland, Ohio (No set figure, but fuel must be approved for the equipment in which it is to be used.)
Columbus, Ohio None. (Limitations on the use of bituminous coal in specific types of equipment.)
Davenport, Iowa. None
Denver, Colo. None
Detroit, Mich.[5] 23% (ash- and moisture-free basis), with qualifications.
Hudson Co., N. J. None. (Use of bituminous coal in vertical fire-tube boilers prohibited.)
Indiana Coal Trade Assoc. None.
Los Angeles Co., Calif. None.
Louisville, Ky. None.
Minneapolis, Minn.[6] 20% (dry basis), with qualifications.
Nashville, Tenn.[7] 23% (dry basis), with qualifications.
Philadelphia, Pa. None.
Pittsburgh, Pa.[8] 20% (dry basis), with qualifications.
St. Louis, Mo. [9] 23% (dry basis), with qualifications.
Stoker Mfgs. Assoc. None.
Toronto, Ont., Can. None.
Washington, D. C. None.

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[1] It shall be unlawful to import, sell, offer for sale, expose for sale, or exchange for use and consumption in the City of Baltimore, or to use or consume in the City of Baltimore, any solid fuel for hand-firing or surface-burning types of equipment that does not meet the standard of a smokeless solid fuel as set forth in this section. Smokeless solid fuel, for the purpose of the enforcement of this subtitle, shall be considered a fuel, the volatile content of which is 23 percent or less on a dry basis. Provided, however, that if a fuel contains volatile matter in excess of 23 percent on a dry basis, it shall be acceptable under the terms of this subtitle provided that it meets the same standards in regard to smoke production as that of a fuel containing less than 23 percent volatile matter on a dry basis; provided that this section shall not apply to homes of three families or less.

[2] The use of high-volatile fuel in any hot-water heater is prohibited unless such hot-water heater be equipped with an approved smokeless furnace or approved stoker.

3/ Boilers of a type and size listed below are to be installed under a fuel agreement. By fuel agreement is meant an agreement to use smokeless fuels, such as hard coal, coke, or semibituminous coal containing less than 20 percent volatile matter analyzed on a dry basis.

a. Portable boilers that are to be used for locomotive cranes, construction work, or street work. All sizes for temporary use in any location.

b. High-pressure boilers (only one to be allowed in any plant). This includes:

   (1) Firebox boilers as large as 42 inches by 11½ feet, with straight grate.
   (2) Scotch marine boilers containing no more than 400 square feet of heating surface.
   (3) Vertical tubular boilers containing no more than 250 square feet of heating surface.
   (4) Economic boilers as large as No. 7 (36 inches by 9 feet), containing no more than 300 square feet of heating surface.
   (5) H.R.T. boilers containing no more than 350 square feet of heating surface.
   (6) Low-pressure boilers.

The Department of Smoke Inspection and Abatement will not approve or issue permits for the installation of low-pressure heating boilers or hot-water heaters of the surface-burning type for burning bituminous, semibituminous, or semianthracite coal in sizes larger than those having a capacity to supply steam to 1,200 square feet of direct steam radiation or its equivalent or to supply hot water to 2,000 square feet of hot-water radiation. All sizes below these are permitted under fuel agreement. The surface-burning type of coal-burning furnace is defined as a hand-fired furnace in which the fresh fuel is thrown directly on the hot fuel bed.

4/ It shall be unlawful for the period of five (5) years from the effective date (Sept. 1, 1947) of this section to import, sell, offer for sale, expose for sale, exchange, deliver, or transport for use and consumption in the City of Cincinnati, or during said period after June 1, 1947, to use or consume in the City of Cincinnati any solid fuel for hand-firing types of equipment, except equipment certified under section 2501-6(b), which· does not meet the standard of a smokeless solid fuel as hereinafter specified; smokeless solid fuel, for the purpose of this Code, shall be fuel the volatile content of which is not over 26 percent on a dry basis, correct within 2 percent. A processed fuel containing volatile matter in excess of 26 percent on a dry basis shall be considered a smokeless solid fuel, provided it meets the same standards in regard to smoke production as a fuel containing less than 26 percent volatile matter on a dry basis and subject to enumerated conditions in order to ascertain whether or not such standards are met.

5/ Solid fuel not meeting the requirements of this ordinance for a smokeless solid fuel may be used or consumed only in approved mechanical combustion equipment or devices, as provided in the ordinance. For the purpose of the ordinance, a solid fuel the volatile content of which is 23 percent or less on an ash- and moisture-free basis is considered smokeless. Except that if a fuel contains volatile matter in excess of 23 percent on an ash- and moisture-free basis, it shall be acceptable under the terms of this Ordinance, provided that it meets the same standards with regards to smoke production as that of a fuel containing less than 23 percent volatile matter on an ash- and moisture-free basis and subject to various enumerated conditions in order to ascertain whether or not such standards are met in case of violation.

6/ The use of soft coal in traction engines, switching engines, and locomotive engines in the City of Minneapolis is hereby declared to be a nuisance, and such use of soft coal other than smokeless coal in the City of Minneapolis is hereby prohibited; and no person, company, or corporation shall hereafter use or permit or cause to be used any soft coal, other than smokeless coal, in any traction engine, switching engine, or locomotive engine in the City of Minneapolis, Minn.

It shall hereafter be unlawful to burn any fuel or refuse such as semianthracite, bituminous and semibituminous coals, pitch-impregnated woods, rubber, or similar materials having over 20 percent volatile content dry analysis in furnaces that are not constructed for the purpose of securing complete combustion of such materials and for the purpose of preventing smoke. This provision does not apply to private residences or flats and apartment houses containing not to exceed two apartments or flats.

7/ Smokeless solid fuel, for the purpose of the enforcement of this ordinance, shall be considered a fuel the volatile content of which is twenty-three percent (23%) or less on a dry basis. Provided, however, that if a fuel contains volatile matter in excess of twenty-three (23%) percent on a dry basis it shall be acceptable under the terms of this ordinance, provided it meets the same standards in regard to smoke production as those of a fuel containing less than twenty-three percent (23%) volatile matter on a dry basis, and subject to conditions which are enumerated in the ordinance.

Each existing fuel-burning unit in the City of Nashville for producing power and heat, or either of them, or any refuse-burning unit which is used for commercial or industrial purposes or for any other purpose shall use a smokeless fuel or a mechanical fuel-burning device approved by the Superintendent of Smoke Regulation as a proper means of securing complete combustion of the fuel in compliance with this ordinance. The following shall be exceptions to the above provisions of this ordinance:

a. Fuel-burning equipment installed in private residences containing three (3) separate dwelling units or less.
b. Down-draft boilers now installed and operated may be accepted at the discretion of the Superintendent of Smoke Regulation.
c. Fuel-burning equipment in which the fresh fuel is fired by hand, where the Superintendent of Smoke Regulation finds, as a matter of fact, and so certifies, that the fuel-burning equipment is so designed as to automatically burn the fuel smokelessly in a manner so as not to violate the provisions of this ordinance.

[8] It shall be unlawful to import, sell, offer for sale, expose for sale, exchange, deliver, or transport for use and consumption in the City of Pittsburgh, or to use or consume in the City of Pittsburgh, any solid fuel for hand-firing or surface-burning types of equipment which does not meet the standard of a smokeless solid fuel as set forth in this section. Smokeless solid fuel for the purpose of the enforcement of this ordinance shall be considered a fuel, the volatile content of which is 20 percent or less on a dry basis. Provided, however, that if a fuel contains volatile matter in excess of 20 percent on a dry basis, it shall be acceptable under the terms of this ordinance, provided that it meets the same standards in regard to smoke production as that of a fuel containing less than 20 percent volatile matter on a dry basis and subject to enumerated conditions in order to ascertain whether or not such standards are met.

[9] It shall be unlawful to import, sell, offer for sale, expose for sale, exchange, deliver or transport for use and consumption in the City of St. Louis, or to use or consume in the City of St. Louis, any solid fuel for hand-firing or surface-burning types of equipment which does not meet the standard of a smokeless solid fuel as set forth in this section. Smokeless solid fuel, for the purpose of the enforcement of this ordinance, shall be considered a fuel the volatile content of which is 23 percent or less on a dry basis. Provided, however, that if a fuel contains volatile matter in excess of 23 percent on a dry basis, it shall be acceptable under the terms of this ordinance, provided that it meets the same standards in regard to smoke production as that of a fuel containing less than 23 percent volatile matter on a dry basis and subject to enumerated conditions in order to ascertain whether or not such standards are met.